State of California The Resources Agency

Memorandum

To : Files Date : March 26, 1990

From : Department of Fish and Game

Subject: Results of Sampling Fish in Sections of Red Clover Creek, Plumas County, 1988.

INTRODUCTION

A previous study of standing stocks of fishes in Red Clover Creek established stations for long-term studies of trout populations in this and other major tributaries to Indian Creek (Brown, 1976). Red Clover Creek is the site of a proposed and authorized dam (Abbey Bridge) that would be part of the State Water Project. The creek is an important source of rainbow trout (Oncorhynchus mykiss) in the Indian Creek system. It is also the site of projects designed to reduce quantities of granitic sand flowing into Indian Creek and the Feather River.

The purpose of this investigation is to monitor status of trout populations as relative abundance, age and growth, length, weight, and condition.

METHODS

Standing stocks of fishes were estimated at four stations in Red Clover Creek Plumas County (Figure 1). Sampling of Red Clover Creek took place previously in 1976. Stations sampled on September 21-23, 1988 were located as close to older stations as access allowed. The length, average width, and average depth of each station was measured. Fish were captured with a battery-

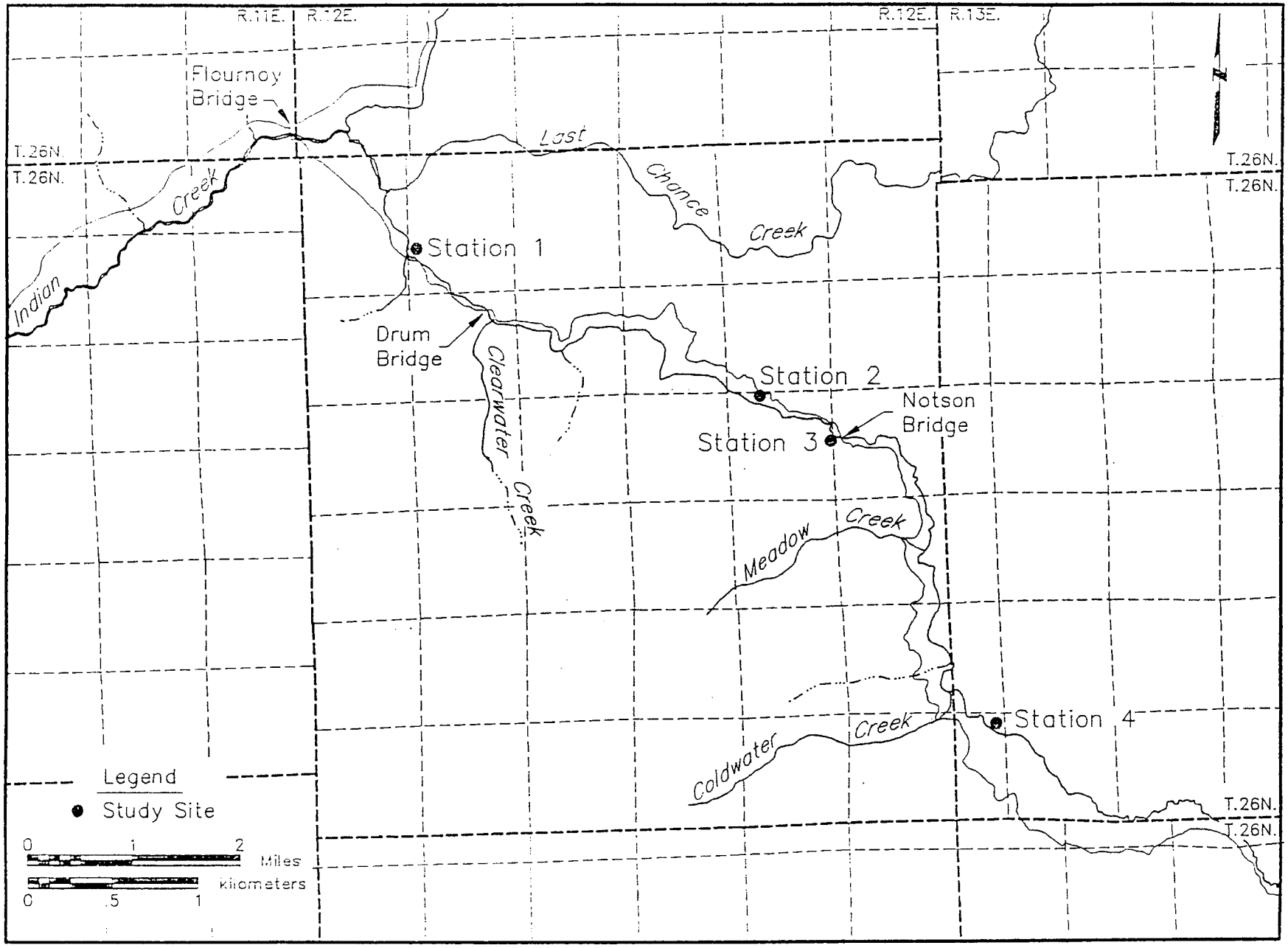

Figure 1. Stations Sampled to Estimate Standing Crop of Trout in Red Clover Creek, Plumas County, 1988.

powered backpack electroshocker (Smith-Root, Type VII) in stream sections blocked by seines. Captured fish were removed from the net-enclosed section after each pass. Standing stock estimates were developed using the two pass method of Seber and LeCren (1967) or the multiple-pass method of Leslie and Davis (1939) with limits of confidence computed using a formula proposed by Delury (1951).

The weights of rainbow trout, brown trout (Salmo trutta), Sacramento sucker (Catostomous occidentalis) and speckled dace (Rhinichthys osculus) were determined by displacement. Weights were measured for all fish caught. Fork length of each fish caught was measured to the nearest millimetre.

Scale samples were taken from all rainbow trout over 100 mm fork length. Scale samples were taken from the six brown trout captured but not from the suckers or speckled dace. Scales were mounted dry between microscope slides, and their images were projected on a NCR microfiche reader at a magnification of 42x. Scale measurements for the calculation of growth were recorded to the nearest millimetre along the anterior radius of the anterior-posterior axis of the scale.

Geometric mean functional regressions were used to describe the body-scale and length-weight relationships (Ricker 1975). Estimation of true mean growth rate (G) was calculated using methods of Ricker (op. cit).

Distribution of all fish caught is listed according to location. Standing crops of rainbow trout and brown trout were calculated for individual

stations where the species of interest were caught and combined for the entire creek. Age and growth were calculated for the population. Mean individual and length-weight relationships were determined only for rainbow trout in Red Clover Creek. The coefficient of condition and 95% confidence intervals were calculated only for rainbow trout.

RESULTS

Distribution

Rainbow trout were caught at all stations except Notson Bridge. Brown trout were caught in the lower creek and mid creek sections. Speckled dace and suckers were caught at all but the lowermost station (Table 1).

Table 1. Distribution of fishes in sections of Red Clover Creek, Plumas County, 1988

	Station			
Distance above creek mouth (km)	2.4	9.7	10.3	13.0
Rainbow trout	X	X		X
Brown trout	X		X	
Speckled dace		X	X	X
Sacramento Sucker		X	X	X

Standing Crop

Rainbow trout were the most common game fish caught in Red Clover Creek. Biomass averaged 5.6 g/m^2 at three stations. Biomass for rainbow trout large enough for fisherman to catch and keep (127mm FL) averaged 5.5 g/m^2 (Table 2). Brown trout biomass averaged 0.16 g/m^2 at two stations with no catchables caught (Table 3).

Speckled dace and Sacramento sucker were the only non-salmonid fish caught in Red Clover Creek. Biomass was 1.2 g/m^2 for speckled dace and 0.8 g/m^2 for Sacramento sucker (Table 4).

Table 2. Estimate of Rainbow Trout Standing Crop in Red Clover Creek, Plumas County, 1988.

Distance (km)	Population Estimate	95% Confidence Interval	Biomass g/m^2	Estimate of Catchable Trout (≥127mm FL)	Biomass of Catchable Trout g/m^2
2.4	118	69-200	10.2	47	9.2
9.7	30	29-32	6.4	26	6.2
13.0	48	44-56	0.2	-	-

Table 3. Estimate of Brown Trout Standing Crop in Red Clover Creek, Plumas County, 1988.

Distance (km)	Population Estimate	95% Confidence Interval	Biomass g/m^2	Estimate of Catchable Trout (≥127 mm FL)	Biomass of Catchable Trout g/m^2
2.4	5	3-7	0.3	-	-
13.0	1	1-1	0.02	-	-

Table 4. Estimates of Standing Crop of Nongame Fishes in Red Clover Creek, Plumas County, 1988

Distance (km)	Species	Population Estimate	95% Confidence Interval	Biomass g/m^2
9.7	Speckled dace	1058	94-9432	1.8
9.7	Sacramento sucker	12	11-14	1.3
10.3	Speckled dace	2433	494-5812	1.4
10.3	Sacramento sucker	2	2-2	0.04
13.0	Speckled dace	406	141-914	0.5
13.0	Sacramento sucker	124	106-144	1.0

Age and Growth

The formula L=14.5 + 4.5S describes the relationship between the fork length (L) and enlarged scale radius (s) of 80 rainbow trout caught in Red Clover Creek. The coefficient of correlation (r^2) is 0.66. Age and growth analysis for brown trout was not possible because all six trout caught had regenerated scales.

Population growth rate and mean individual growth of age 1+ rainbow trout was faster than age 2+ (Table 5). Age 1+ rainbow trout averaged 152 mm, 2+ averaged 202 mm, and 321 mm for 3+ fish. (Table 6).

Table 5. Growth Rates For Rainbow Trout Caught in Red Clover Creek, Plumas County, 1988

	Population Growth			Mean Individual Growth		
Age Interval	Length Interval (mm)	Difference of Natural Logarithms	Instantaneous Growth Rate Gx	Length Interval (mm)	Difference of Natural Logarithms	Instantaneous Growth Rate Gx
1-2	64-161	0.923	7.89	63-161	0.938	0.802
2-3	161-248	0.432	0.59	142-248	0.558	0.761

Table 6. Calculated Fork Length in Millimetres of Rainbow Trout from Red Clover Creek, Plumas County, 1988.

Age	No. of Fish	Length at Capture (mm)	Calculated Lengths at Successive Annuli 1	2	3
1	80	152	64	-	-
2	15	202	63	161	-
3	2	321	60	142	248
Number of back-calculations			97	17	2
Weighted Means (mm)			64	159	248
Increments (mm)			64	95	89

Length and Weight

Age group 0+ rainbow trout represented 49% of the catch. Ages 1+ and 2+ fish represented 40 and 10 percent respectively, while 3+ fish made up 1 percent (Figure 2). (Appendices 2 and 3). Brown trout length and number, and length and weight data can be found in Appendices 4 and 5.

The relationship between length (L) and weight (W) of rainbow trout is:

$Log_{10}W=-4.79 + 2.92\ Log_{10}L$

$r^2=0.99$

N=152 (Figure 3).

Coefficient of Condition

The coefficient of condition and 95% confidence limits for 154 rainbow trout were calculated (Table 7). There is no significant difference between the coefficient of condition for any age group of rainbow trout that were tested ("t" test, 0.05 level).

Table 7. Condition of Rainbow Trout in Red Clover Creek, Plumas County, 1988.

Age Group	Number of Fish	Coefficient of Condition	95% Confidence Interval
0+	76	1.3975	1.081-1.225
1+	62	1.1270	1.091-1.163
2+	15	1.1390	1.086-1.192
3+	1	1.0546	-
Combined	154	1.1795	1.086-1.193

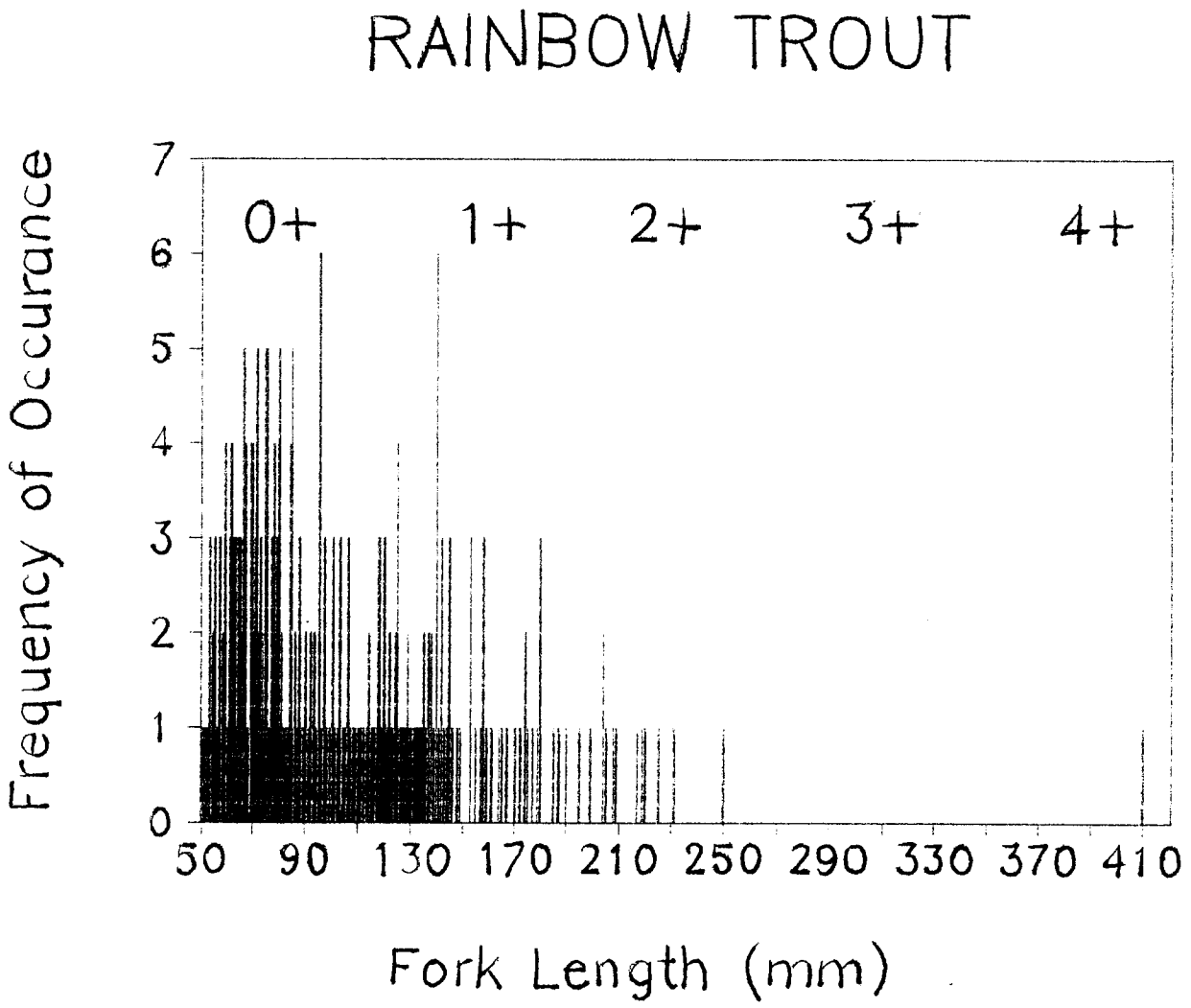

FIGURE 2. Length, observed frequency, and age of rainbow trout caught in Red Clover Creek, Plumas County, 1988.

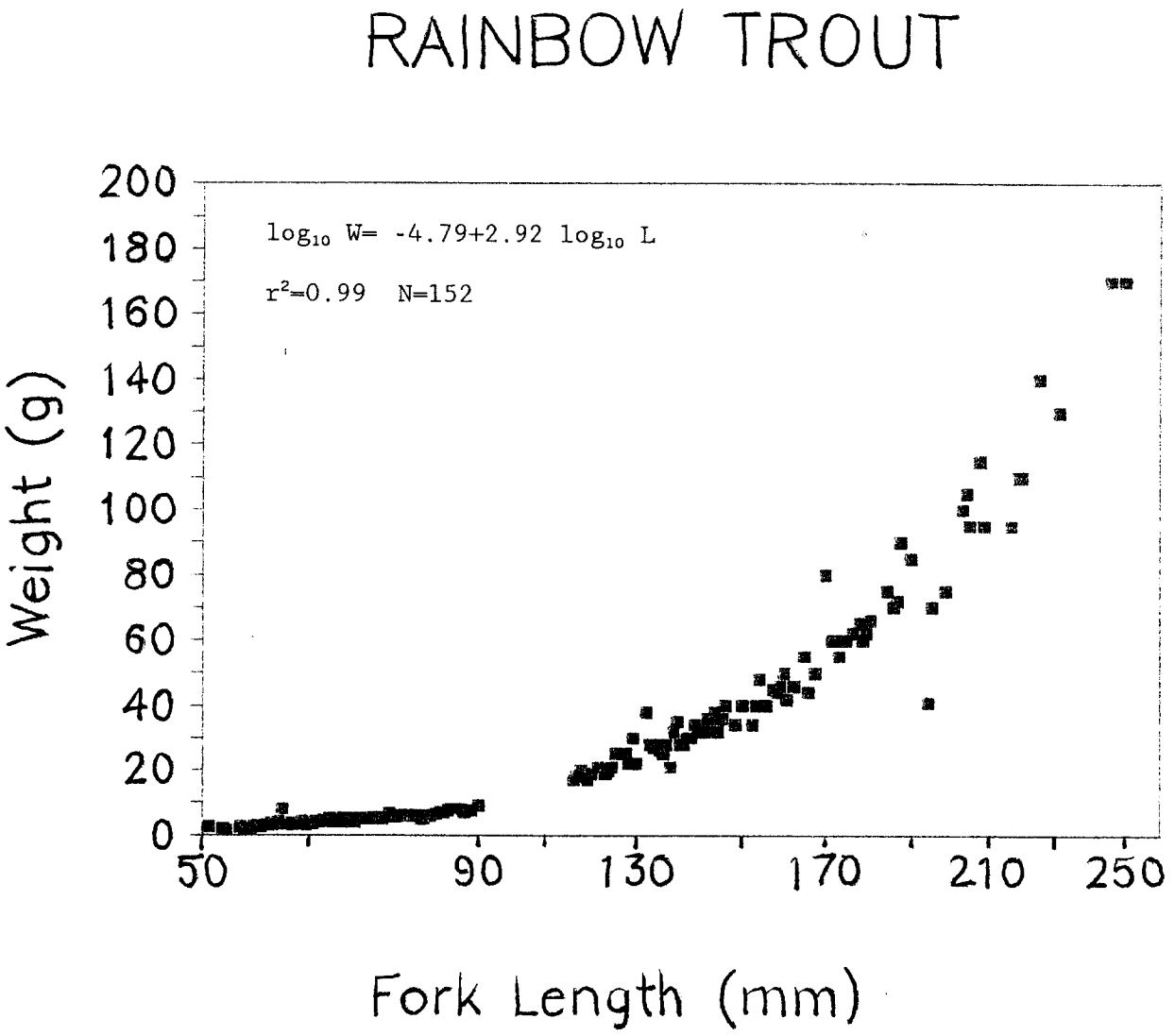

FIGURE 3. The relationship between length and weight of rainbow trout in sections of Red Clover Creek, Plumas County, 1988.

DISCUSSION

Stations were not identical to those sampled in Brown (1976); however, two stations were located near previous stations. The lower is located 2.4 km above the confluence of Red Clover Creek and Indian Creek and the upper station is 13.0 km above the confluence. Biomass of trout (rainbow and brown trout) in the lower station increased from 1.3 g/m^2 in 1976 to 10.5 g/m^2 in 1988. Few nongame fish were caught either year. Trout biomass at the upper site was similar in 1976 and 1988. The upper site trout biomass was 0.3 g/m^2 in 1976 and 0.2 g/m^2 in 1988. Biomass of nongame fish was 0.5 in 1976 and 1.5 in 1988 (Table 8).

Table 8. Biomass of fishes caught in Red Clover Creek, 1976 and 1988.

Station	Biomass (g/m^2)			
	1976		1988	
	Trout	Non-game	Trout	Non-game
Lower canyon	1.3	0.1	10.5	0
Upper canyon	0.3	0.5	0.2	1.5

LITERATURE CITED

Brown, C. J. 1976. Standing stocks of fishes in sections of Red Clover, Little Last Chance, Big Grizzly, Last Chance, and Squaw Queen Creeks, Plumas County, 1976. Calif. Dept. Fish and Game, Info. Rept. No. 76-4. 8p.

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APPENDIX 1

FISH POPULATION STATIONS FOR RED CLOVER CREEK,
PLUMAS COUNTY, SEPTEMBER 1988

Station 1 - Located 2.4 stream km upstream from the confluence with Indian Creek. Drive up Genesee-Beckwourth Road (26N16) 2.7 km above Flournoy Bridge to a small, dry watercourse. Hike down hill about 46 m. to Red Clover Creek, near the site of the abandoned DWR Red Clover near Genesee streamgage (SE 1/4 of SW 1/4, Section 5, T2N, R12E). This station is labeled RC-3 in DFG Region 2 files and C2 in Erick Gerstung's data summaries. The station is comprised primarily of large boulders and is mostly a deep run (95%) with some pool area (5%). It is 30.5 m long, with average width of 7.9 m, and average depth of 0.42 m, giving it a surface area of 241 m^2 and a volume of 101 m^3.

Station 2 - Located 9.7 stream km upstream from the confluence with Indian Creek. Drive up Genesee-Beckwourth Road about 11.3 km to the campsite at the top of the canyon. Hike down to the stream adjacent to the campsite (SW 1/4, NE 1/4, Section 14, T25N, R12E). This station has many large boulders but also some gravel and sand bottom areas. It is mostly pool area (66%) with some run (19%) and riffle (15%). Its length is 45.7 m, with an average width of 6.4 m, and an average depth of 0.3 m, giving it a surface area of 292 m^2 and a volume of 88 m^3.

Station 3 - Located 10.3 stream km upstream from the confluence with Indian Creek. Drive up the Genesee-Beckwourth Road about 12.6 km to Notson Bridge

(SW 1/4, NW 1/4, Section 13, T25N, R12E). The station is located immediately downstream. The station is primarily small gravel, sand and rubble. It is primarily riffle (90%) with a few shallow pools (10%). Its length is 80.5 m, with an average width of 8.8 m, and an average depth of 0.13 m, giving it a surface area of 708 m^2 and a volume of 92 m^3.

Station 4 - Located 13.0 stream km upstream from the confluence with Indian Creek. Drive up to the Genesee-Beckwourth Road about 16.1 km above Flournoy Bridge and turn left on a spur road. Drive 0.3 km down the spur road. The station is located just upstream of a dry tributary and downstream from a live tributary (SE 1/4, NE 1/4, Section 24, T25N, R12E). This station is labeled RC-2 in DFG Region 2 files and C3 in Eric Gerstung's data summaries. The substrate is mostly volcanic with a small amount of sand and gravels. The station is broken up by bedrock outcroppings and is primarily pool (74%) and riffle (23%) with a small amount of run (3%). We estimated it was about half water surface and half bedrock islands. The station is 84 m long, with an average width of 11.9 m, and an average depth of 0.2 m, giving it a surface area of 500 m^2 and a volume of 100 ^{3}.

APPENDIX 2

LENGTH AND WEIGHT OF RAINBOW TROUT

CAUGHT IN RED CLOVER CREEK, 1988

APPENDIX 2

LENGTH AND WEIGHT OF RAINBOW TROUT
CAUGHT IN RED CLOVER CREEK, SEPTEMBER 1988

Fork Length (mm)	Weight (g)	Fork Length (mm)	Weight (g)
52	2.5	138	21,32
56	2	139	35
57	1.5	140	2(28),2(30),34
61	2.5,2(3)	141	32
62	2.5,3	142	2(32),36
63	2.5,3,3.5	143	36
64	3	144	38
65	3.5,4,8	145	32,36,40
66	2(3.5)	148	34
67	3,2(3.5),4	150	40
68	3	153	34,40,48
70	2(3.5),2(4)	155	40
71	2(4.5),5	157	45
72	4	158	44,46,50
73	4,4.5,5	159	42
74	4,5	161	46
75	4,4(5)	164	55
76	5	165	44
77	5.5	167	50
78	2(5),5.5,6.5	170	80
79	2(5.5)	172	60
80	5(6)	174	55,60
81	5,5,6	175	60
82	6	177	62
84	6.5	179	65
85	2(7),7.5,2(8)	180	60,62,66
87	8	185	75
88	7,2(7.5)	187	70,72,90
90	9	190	85
118	17,18,20	195	41,70
119	18	199	75
120	17	204	100,105
121	19	205	95
123	21	208	115
125	19,20,21,25	209	95
128	25	217	95
129	22,30	219	110
130	22	220	110
133	38	225	140
134	28	231	130
135	27,28	246	170
136	26	250	170
137	25,28	410	no weight

APPENDIX 3

LENGTH AND NUMBER OF RAINBOW TROUT
CAUGHT IN RED CLOVER CREEK, 1988

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LENGTH AND NUMBER OF RAINBOW TROUT
CAUGHT IN RED CLOVER CREEK, 1988

Fork Length	Number	Fork Length	Number
52	1	138	2
56	1	139	1
57	1	140	6
61	3	141	1
62	2	142	3
63	3	143	1
64	1	144	1
65	3	145	3
66	2	148	1
67	4	150	1
68	1	153	3
70	4	155	1
71	3	157	1
72	1	158	3
73	3	159	1
74	2	161	1
75	5	164	1
76	1	165	1
77	1	167	1
78	4	170	1
79	2	172	1
80	5	174	2
81	2	175	1
82	1	177	1
84	1	179	1
85	5	180	3
87	1	185	1
88	3	187	3
90	1	190	1
118	3	195	2
119	1	199	1
120	1	204	2
121	1	205	1
123	1	208	1
125	4	209	1
128	1	217	1
129	2	219	1
130	1	220	1
133	1	225	1
134	1	231	1
135	2	246	1
136	1	250	1
137	2	410	1

APPENDIX 4

LENGTH AND WEIGHT OF BROWN TROUT
CAUGHT IN RED CLOVER CREEK, 1988

APPENDIX 4

LENGTH AND WEIGHT OF BROWN TROUT
CAUGHT IN RED CLOVER CREEK, 1988

Fork Length (mm)	Weight (g)
95	11
110	18
95	10
105	16
105	15
111	16

APPENDIX 5

LENGTH AND NUMBER OF BROWN TROUT
CAUGHT IN RED CLOVER CREEK, 1988

APPENDIX 5

LENGTH AND NUMBER OF BROWN TROUT
CAUGHT IN RED CLOVER CREEK, 1988

Fork Length (mm)	Number
95	2
105	2
110	1
111	1

APPENDIX 6

METRIC CONVERSION FACTORS

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METRIC CONVERSION FACTORS

Quantity	Metric Units	Divide by	English Units
Length	millimetres (mm)	25.4	inches (in)
	centimetres (cm)	2.54	inches (in)
	metres (m)	0.3048	feet (ft)
	kilometres (km)	1.6093	miles (mi)
Area	square metres (m^2)	0.0929	square feet (ft^2)
Volume	cubic metres (m^3)	0.7646	cubic yards (yd^3)
Flow	cubic metres per second (cms)	0.0283	cubic feet per second (cfs)
Biomass	grams per square metre (g/m^2)	8.92	pounds per acre (lb/acre)